

WHAT IS CLAIMED IS:

1. An ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising:

a probe configured to transmit/receive an ultrasound wave to/from the subject;

a transmission circuit configured to drive said probe to transmit an ultrasound wave while sequentially changing a direction of an ultrasound transmission line;

a reception circuit configured to generate reception line data of the number of parallel reception from ultrasound echo signals obtained by one ultrasound wave transmission;

a transmission/reception control circuit configured to control said transmission and reception circuits to change the number of parallel reception during a scan sequence for generating a 1-frame ultrasound image; and

an image processing unit configured to generate an ultrasound image on the basis of the reception line data.

2. An apparatus according to claim 1, wherein when generating one ultrasound image, said an image processing unit uses N adjacent reception line data generated from ultrasound echo signals obtained

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by one ultrasound transmission, centering around  
a transmission direction, in a short-distance region,  
and uses  $n$  ( $n < N$ ) adjacent reception line data  
generated from ultrasound echo signals obtained by  
5 one ultrasound transmission, centering around  
a transmission direction, in a long-distance region.

3. An apparatus according to claim 1, wherein  
said transmission/reception control circuit  
changes the number of parallel reception in a first  
10 partial region and a second partial region, and  
said transmission circuit sets an ultrasound focus  
point in a long-distance region when transmitting  
an ultrasound wave to the first partial region and when  
transmitting an ultrasound wave to the second partial  
15 region.

4. An apparatus according to claim 1, wherein  
said an image processing unit generates an ultrasound  
image on the basis of a harmonic component obtained by  
removing a fundamental wave component from the  
20 ultrasound echo signal.

5. An apparatus according to claim 1, wherein  
said transmission/reception control circuit changes  
the number of parallel transmission/reception to not  
less than three different numbers within one frame.

25 6. An ultrasound diagnostic apparatus for  
obtaining an ultrasound image of a subject into which  
an ultrasound contrast agent mainly composed of

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a probe configured to transmit/receive an ultrasound wave to/from the subject;

a reception circuit configured to generate reception line data of the number of times of parallel reception from ultrasound echo signals obtained by one ultrasound wave transmission; and

7. An ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising:

a transmission circuit configured to drive said

probe to transmit an ultrasound wave while sequentially changing a direction of an ultrasound transmission line and drive said probe such that the ultrasound transmission lines are formed into a plurality of sets each constituted by a plurality of adjacent transmission lines, scanning is performed with respect to the plurality of sets in a forward direction, and scanning is performed in a reverse direction in each of the sets;

a reception circuit configured to generate reception line data from an ultrasound echo signal obtained by the ultrasound transmission; and

an image processing unit configured to generate an ultrasound image on the basis of the reception line data.

8. An apparatus according to claim 7, wherein said transmission circuit sequentially switches a focus point position of an ultrasound wave to be transmitted in a scan sequence for obtaining a 1-frame ultrasound image at a long distance and short distance.

9. An ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising:

a probe configured to transmit/receive an ultrasound wave to/from the subject;

a transmission circuit configured to drive said

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probe to transmit an ultrasound wave while sequentially changing a direction of an ultrasound transmission line;

5 a reception circuit configured to generate reception line data from ultrasound echo signals obtained by transmission of the ultrasound wave; and

10 a transmission/reception control circuit configured to control said transmission and reception circuits to scan a plurality of local regions within a scan slice in different transmission conditions.

15 10. An apparatus according to claim 9, wherein said transmission/reception control circuit performs transmission in different transmission conditions in the respective local regions so as to correct a difference in collapse degree of the bubbles due to an influence of a tissue distribution in the object.

20 11. An apparatus according to claim 9, wherein said transmission control circuit changes at least one of a driving voltage for a transducer, a size of a focus point, an opening area, the number of elements driven by an ultrasound transducer, and an ultrasound transmission frequency.

25 12. An apparatus according to claim 9, wherein said transmission/reception control circuit respectively sets transmission conditions for the plurality of local regions so as to make transmission sound pressures constant with respect to the plurality

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of local regions.

13. An apparatus according to claim 9, further comprising a storage unit storing a plurality of patterns of templates indicating a shape in which the slice is segmented into local regions and transmission conditions in the respective local regions.

14. An apparatus according to claim 9, further comprising an input device configured to segment the slice into a plurality of local regions.

15. An apparatus according to claim 9, wherein said transmission/reception control circuit comprises an input device for manually designating at least one representative point within the slice, and means for obtaining a segmentation shape of the slice in accordance with the designated representative point.

16. An apparatus according to claim 9, wherein said an image processing unit generates a mosaic image on the basis of a reception signal intensity obtained for each of the local regions.

17. An apparatus according to claim 16, wherein the mosaic image is painted in colors corresponding to the reception signal intensities for the respective local regions.

18. An apparatus according to claim 16, wherein numerical values or characters corresponding to the reception signal intensities in the respective local

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regions are written in the mosaic image.

19. An ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising:

a probe configured to transmit/receive an ultrasound wave to/from the subject;

a transmission circuit configured to transmit an ultrasound wave to form a period during which a contrast agent flows into the object and a period during which microbubbles are collapsed by an ultrasound wave and driving said probe to perform ultrasound transmission so as to obtain ultrasound echo data corresponding to a plurality of frames in the microbubble collapse period; and

an image generating unit configured to generate images of the plurality of frames on the basis of ultrasound echo signals received by said probe and a combined image by combining the plural images.

20. An apparatus according to claim 19, wherein said image generating unit compares luminance values at the same coordinates of the images of the plurality of frames, and sets a maximum luminance value as a luminance value of the combined image.

21. An apparatus according to claim 19, further comprising a display unit for displaying the combined image in real time, together with the image of each

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frame.

22. An ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising:

a probe configured to transmit/receive an ultrasound wave to/from the subject;

a transmission circuit configured to transmit an ultrasound wave to form a period during which a contrast agent flows into the object and a period during which microbubbles are collapsed by an ultrasound wave and driving said probe to perform ultrasound transmission on a single scanning line a plurality of number of times;

a reception circuit configured to generate reception line data from an ultrasound echo signal obtained by transmission of the ultrasound wave; and

an image generating unit configured to generate an image by combining portions of the reception line data on the single scanning line.

23. A scanning method for an ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast agent mainly composed of microbubbles is injected, comprising the steps of:

performing first ultrasound transmission to sequentially transmit ultrasound waves while

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sequentially changing a direction of an ultrasound transmission line;

performing second ultrasound transmission to transmit an ultrasound wave to a line between  
5 ultrasound transmission lines in the first ultrasound transmission;

performing first reception to generate reception line data of a plurality of reception scanning lines from ultrasound echo signals obtained by performing  
10 the first ultrasound transmission once;

performing second reception to generate reception line data of reception scanning lines different in number from that in the step of performing the first reception from ultrasound echo signals obtained by  
15 performing the second ultrasound transmission once; and

generating one ultrasound image by combining the reception line data obtained in the step of performing the first and second receptions.

24. A scanning method for an ultrasound diagnostic  
20 apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast medium mainly composed of microbubbles is injected, comprising the steps of:

performing first ultrasound transmission to  
25 sequentially transmit ultrasound waves while sequentially changing a direction of an ultrasound transmission line;

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performing second ultrasound transmission to transmit an ultrasound wave to a line between ultrasound transmission lines in the first ultrasound transmission;

5           generating first reception line data on the basis of ultrasound echo signals of a short-distance portion and long-distance portion obtained by the first ultrasound transmission, and generating second reception line data on the basis of the ultrasound echo  
10           signal of the short-distance portion obtained by the first ultrasound transmission and the ultrasound echo signal of the long-distance portion obtained by the second ultrasound transmission; and

            generating a 1-frame ultrasound image on the basis  
15           of the reception line data.

25. A scanning method for an ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast medium mainly composed of microbubbles is injected, comprising the  
20           steps of:

            transmitting ultrasound waves such that the ultrasound transmission lines are formed into a plurality of sets each constituted by a plurality of adjacent transmission lines, scanning is performed  
25           with respect to the plurality of sets in a forward direction, and scanning is performed in a reverse direction in each of the sets;

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generating reception line data from an ultrasound echo signal obtained by the ultrasound transmission; and

5 generating an ultrasound image on the basis of the reception line data.

26. A scanning method for an ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast medium mainly composed of microbubbles is injected, comprising the steps of:

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transmitting/receiving an ultrasound wave in different transmission conditions in local regions so as to correct a difference in collapse degree of the bubbles due to an influence of a tissue distribution in the object; and

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generating an ultrasound image on the basis of an ultrasound echo obtained by the ultrasound transmission.

27. A scanning method for an ultrasound diagnostic apparatus for obtaining an ultrasound image of a subject into which an ultrasound contrast medium mainly composed of microbubbles is injected, comprising the steps of:

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transmitting/receiving an ultrasound wave to form a period during which a contrast medium flows into the object and a period during which microbubbles are collapsed by an ultrasound wave, and performing the

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generating images of the plurality of frames on  
the basis of ultrasound echo signals obtained by the  
transmission/reception, and generating a combined image  
by combining the respective images.

transmitting/receiving an ultrasound wave to form  
a period during which a contrast medium flows into the  
15 object and a period during which microbubbles are  
collapsed by an ultrasound wave and performing  
ultrasound transmission/reception on a single scanning  
line a plurality of number of times;

generating reception line data from an ultrasound  
20 echo signal obtained by the transmission/reception; and  
generating an image by combining portions of the  
reception line data on the single scanning line.